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UNMANNED AIRCRAFT SYSTEMS – IS THE COMMANDER GETTING WHAT IS NEEDED?

BY

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One of the tools the Joint Force Commander has in his kit today that deals with the challenge of gaining accurate knowledge of enemy, friendly and neutral forces, as well as the terrain they operate in, is the Unmanned Aircraft System (UAS). This paper discusses the disjointed rise of UASs in American warfare, and their status today after a century of sporadic development punctuated by a tsunami-like rise to prominence over the relatively short span of the last ten years. Fueled by the needs of commanders in combat, the rise of the machines reflects a need generated by a capability gap recognized across the Joint Force. The speed and focus each service dedicated to filling this gap has left many disjointed systems across the Department of Defense, most of which are not truly interoperable. The number one capability the Combatant Commanders are asking for is reconnaissance and surveillance and there is fervent agreement on this. The question remains: are the commanders getting what they need? A close examination of their capabilities and limitations, and more critically what is being addressed under the rubric of interoperability, would indicate that they are not.

UNMANNED AIRCRAFT SYSTEMS - IS THE COMMANDER GETTING WHAT IS NEEDED?

In February of 2010, the Department of Defense published their latest Quadrennial Defense Review (QDR), touting it as the first truly wartime QDR. In the document's preface, Secretary of Defense Robert M. Gates describes it as an important step toward fully institutionalizing the ongoing reform and reshaping of America's military – shifts that rebalance the urgent demands of today and the most likely and lethal threats of the future.[1] This indeed is one of the two stated objectives within the QDR. The second is to further reform the Defense Department's institutions and processes to better support the urgent needs of the Warfighter by procuring weapons that are usable, affordable, and truly needed.[2] The body of the QDR elaborates on the direction of the nation and its armed forces, but very few specific systems are mentioned in the framework of expansion or development more than once: Unmanned Aircraft Systems (UAS) are the exception. In the view of the authors of the QDR, UASs are poised to become even greater key enablers for the Joint forces, and are linked to Counter Insurgency (COIN) operations, aircraft carrier launched strike missions, communications relay operations, and ballistic missile tracking, to name a few.[3]

The focus on unmanned aviation systems is driven by many factors. First and foremost is their phenomenal success on the battlefield in both the conflicts in Iraq and Afghanistan. As a result of this success, they are now an integral asset for every branch of the military service in today's fight, and the demand for their capabilities far outstrips their availability across the Joint domain. One less-celebrated reason for the focus on these unmanned aerial systems is a consequence of this same success. Because of the insatiable demand for these systems, numerous UAS programs across the Department of Defense (DoD) were rushed into fielding. This haste to meet the requirements of Combatant Commanders was made for all the right reasons, but has had some negative consequences.

Today's Joint Force Commanders face many challenges in the execution of ongoing conflicts and management of regional tensions spanning the globe. The term "hybrid" has recently been used to capture the seemingly increased complexity of these conflicts and tensions, which portrays an environment populated by a diversity of actors adept at blurring the lines between the traditional categories of conflict. This hybrid construct may involve state adversaries that employ protracted forms of warfare, possibly using proxy forces to coerce and intimidate, or non-state actors using operational concepts and high-end capabilities traditionally associated with states.[4] While some will argue that the existence of this threat is far from new, one repercussion of recognizing these hybrid approaches is that U.S. forces must return to a doctrine that prepares for a range of military conflicts.

Regardless of what form the threat takes, or what range of the spectrum commanders must operate in, they do have an astounding array of assets with which to execute their mission. The commanders of a mere century ago would be awed by the capabilities of today's force. Interestingly enough, today's commanders are using these astounding capabilities in an attempt to address some of the very same perplexing issues that antagonized their predecessors. Key amongst those issues, arguably, is the knowledge of enemy, friendly, and neutral forces. This knowledge, combined with an understanding of the environment these forces are operating in or receiving support from, provides the commander with “situational awareness.” As most military theorists, historians, and practitioners will agree, without knowledge of these elements, efforts in war will be largely unsuccessful.

One of the tools the Joint Force Commander has in his kit today that deals with both challenges is the Unmanned Aircraft System. The proliferation of these systems is so great that there is no branch of the United States military that does not depend upon them to accomplish missions of one description or another. This paper discusses the disjointed rise of Unmanned Aircraft Systems in American warfare, and their status today after a century of sporadic development punctuated by a tsunami-like rise to prominence over the relatively short span of the last ten years. Fueled by the needs of commanders in combat, the rise of the machines reflects a need generated by a capability gap recognized across the Joint Force. The speed and focus each service dedicated to filling this gap has left many disjointed systems across the Department of Defense, most of which are not truly interoperable. The number one capability the Combatant Commanders are asking for is reconnaissance and surveillance and there is fervent agreement on this.[5] The question remains: are the commanders getting what they need? A close examination of their capabilities and limitations, and more critically what is being addressed under the rubric of interoperability, would indicate that they are not.

Background

The genesis of modern unmanned flight began in 1915 when Nicola Tesla proposed that an armed, pilotless-aircraft could be used to defend the United States.[6] By 1917, the U.S. Army Air Corps was exploring new ways to aerially deliver bombs without risking the lives of their pilots. The Kettering Aerial Torpedo, nicknamed the "Bug," was the first attempt. The Bug was a system very much like the notorious “Buzz Bombs” the Third Reich would launch at England in the latter half of World War II, in essence, an unmanned flying bomb that would fall out of the sky at a predetermined time after launch. This system never saw combat in World War I, and funding for the system was eliminated completely by 1920.[7]

During the inter war years from 1920 to 1941, the work by both the U.S Army and the U.S. Navy continued sporadically. The Navy produced a UAS that was capable of delivering a 1,000 pound bomb, but could not refine the accuracy of the delivery system to better than 1.5 miles from the target.[8] The Army’s work in the late 30’s managed to build the XC-10, capable of being flown by radio link, but only flew a total of 100 hours on the system over a five-year period. The XC-10 was, however, a valuable research tool for the later development of drone programs that would follow. [9]

During this same time period both the British and the U.S. Navy were heavily involved in the development of target drones. In early 1938, the USS Ranger became the first ship to ever shoot down a target drone.[10] The Navy would continue to find innovative ways to use and improve their UASs. In a prelude to what was to come, the Navy utilized a UAS controlled by a chase plane to successfully drop torpedoes and depth charges on targets. The UAS was equipped with a television “eye” that transmitted pictures of the target back to the chase plane.[11]

During World War II, an attempt was made to utilize B-17 and B-24 bomber aircraft filled with explosives to destroy targets within heavily defended sectors of Germany. The aircraft required a crew to man them for takeoff, and then bail out once the chase plane had radio control. None of the missions were successful.[12] After the war there was little interest in using UAS to replace manned aircraft. The success of target drones, however, spurred their further development significantly. In fact, the first of the modern target drones was loosely based on the successful German V-1, commonly referred to as “Buzz Bombs.”

In 1951, the first jet-powered target drone, the Teledine Ryan Firebee, made its debut. Ryan Aeronautical was convinced that the target drones could be used for unmanned reconnaissance missions, especially those involving high risk. They began testing, and in 1959, presented their results to the Air Force. Within the span of the next two months, the USSR shot down both a U.S. U-2 reconnaissance aircraft and an electronic intelligence aircraft. These events helped spur the procurement of the Firebee UASs. The Firebee would evolve into a system capable of conducting high altitude reconnaissance at the strategic level, as well as a plethora of additional systems capable of supporting missions down to the tactical level. This UAS saw prolific use in the Vietnam conflict in roles as varied as leaflet drops, low-altitude reconnaissance, signals intelligence and air defense decoys.[13]

During the late 1970’s and throughout the 1980’s, the Israeli Air Force, an aggressive UAV developer, pioneered several important new UAVs, versions of which were integrated into the UAV fleets of many other countries, including the United States. Israel built the Pioneer UAV in the late 1980’s, and after witnessing Israel's numerous successes with light UAVs, the U.S. Navy, Marines, and Army immediately acquired more than 20 of the new Pioneers, which became the first small, inexpensive UAVs in the modern American military inventory. During the 1991 Operation DESERT STORM, the Pioneer made its debut as the first UAS used extensively for surveillance in a conflict by the United States, with a total of 533 sorties. It also saw considerable use later in Bosnia.[14]

The advent of the larger and more capable Predator and Global Hawk UASs in the 1990's has set the stage for the systems that are proliferating across the services today. During their development, and even today, unmanned aerial systems have gone by a variety of names. The most recent definition within Joint doctrine defines the terms as follows: drone, a land, sea, or air vehicle that is remotely or automatically controlled; Unmanned Aircraft (UA), an aircraft or balloon that does not carry a human operator and is capable of flight under remote control or autonomous programming; Unmanned Aircraft System (UAS), that system whose components include the necessary equipment, network, and personnel to control an unmanned aircraft. While Joint Doctrine uses the terms Remotely Piloted Vehicle (RPV) and Unmanned Aircraft Vehicle (UAV), it does not define them.[15] Since this paper focuses on not just the vehicle, but the system that provides a capability, the term UAS will be used to encompass all of these definitions.

Since commanders are asking for UAS to bridge a reconnaissance and surveillance capability gap, it is germane to understand how UAS are characterized. The Joint Forces Command's Joint UAS Center for Excellence established a system to categorize UASs into five groups that are based on attributes of vehicle speed, weight and operating altitude.

UAS Category	Maximum Gross Takeoff Weight (lbs)	Normal Operating Altitude (ft)	Speed (KIAS)	Current / Future Representative UAS
Group 1	0-20	< 1,200 AGL	100 kts	Wasp III, FCS Class I, TACMAV, RQ-14A/B, BUSTER, BATCAM, RQ-11B/C, FPASS, RQ-16A, Pointer, Aqua Terra, Puma
Group 2	21-55	< 3,500 AGL	< 250	Vehicle Craft Unmanned Aircraft System, ScanEagle, Silver Fox, Aerosonde
Group 3	< 1320	< 18,000 MSL		RQ-7B, RQ-15, STUAS, XPV-1, XPV-2
Group 4	> 1320		Any Airspeed	MQ-5B, MQ-8B, MQ-1A/B/C, A-160
Group 5		> 18,000 MSL		MQ-9A, RQ-4, RQ-4N, Global Observer, N-UCAS

Figure1: Joint UAS Group Classification (Chart: U.S. Department of Defense)

Group 1 UASs are typically hand-launched, portable systems employed at the small unit level or for base security. They are capable of providing “over the hill” or “around the corner” type of reconnaissance, surveillance and target acquisition. Payloads are modular such as fixed Electro Optical (EO) / Infrared (IR) systems. Data from these systems is limited to the user / operator, usually within close proximity to the UAS. Group 2 UAS are typically medium-size, catapult-launched, mobile systems that usually support brigade-level and lower Intelligence, Surveillance, and Reconnaissance (ISR) and Reconnaissance, Surveillance, And Target Acquisition (RSTA) requirements.

These systems operate at altitudes less than 3,500 feet above ground level (AGL) with a local to medium range. They usually operate from unimproved areas and do not usually require an improved runway. Payloads may include a sensor ball with EO / IR and a Laser Range Finder / Designator (LRF/D) capability. Group 3 UASs are larger systems that operate at medium altitudes and usually have medium to long range and extended endurance. Their payloads may include a sensor ball with EO / IR, LRF/D, Synthetic Aperture Radar (SAR), moving target indicator, Signal Intelligence (SIGINT), communications relay, and Chemical, Biological, Radiological and Nuclear and high yield Explosives (CBRNE) detection. Some systems carry weapons. They usually operate from unimproved areas and may not require an improved runway. Group 4 UASs are relatively large systems, operate at medium to high altitude, and have extended range and endurance. Their capabilities include payloads that may include EO / IR, radars, lasers, communications relay, SIGINT, Automated Identification System (AIS) and weapons. These systems must meet DoD airworthiness standards prior to operating in National Air Space. Lack of satellite communications (SATCOM) links could inhibit Beyond Line Of Sight (BLOS) capability for some UASs in this group. Additionally, the logistics footprint is equal to that of a manned aircraft organization, usually requiring an improved area for launch and recovery.[16] Group 5 UASs are the largest systems, operate in medium to high altitude environment, and typically have the greatest range, endurance, and airspeed. They perform specialized missions including broad area surveillance and penetrating attacks. Payloads include EO / IR, radars, lasers, communications relay, SIGINT, AIS, weapons, and supplies. They too must meet DoD airworthiness requirements. There are stringent air space requirements levied against Group 5 UAS, and they typically fly BLOS, so lack of SATCOM could force operations in a degraded mode. Currently all Group 5 aircraft reside in the Navy and Air Force.

Joint Mission

Every service utilizes the equipment within its inventory to execute the tasks conferred upon them by the nation. The specificity of these roles necessitates that one branch of service be assigned a general set of missions. Each of the services is also required by law (the Goldwater-Nichols DoD Reorganization Act of 1986) to provide capabilities for the Joint Force. These forces and capabilities are what the Combatant Commanders draw upon to execute their mission. Joint strategic documents are reviewed to identify mission areas where UAS could best serve the Joint force. The Joint Capability Areas (JCA) document describes the portfolios of capabilities that are then applied to meet DoD challenges. Services then link their core functions to the JCAs to identify how they contribute to these Joint capabilities.[17] The prominent rise of UASs has seen every service reevaluate its mission sets to determine if a UAS is a more suitable alternative for the task in lieu of the one currently in place.

U.S. Air Force

The U.S. Air Force has recognized the demand for Intelligence, Surveillance, and Reconnaissance that has emerged from the Combatant Commanders globally. To help meet this demand, they have increased their number of Remotely Piloted Vehicles (RPVs) fielded by 330 percent. The Air Force has also recognized that it is the human aspect of the analysis of the data received from these platforms that transforms it into “actionable” intelligence. Accordingly, they have shifted approximately 3,600 of the

4,100 manpower billets recaptured from the earlier retirement of legacy fighters to support RPA operations, and the Processing, Exploitation, and Dissemination (PED) of intelligence collected by both manned and remotely piloted vehicles.[18]

The Air Force sees its future closely intertwined with UASs. It envisions a family of unmanned aircraft consisting of small man-portable vehicles, including micro and nano-sized vehicles, medium "fighter sized vehicles," large "tanker sized" vehicles, and special vehicles with unique capabilities, all including autonomous-capable operations.[19] Their concept to build a common set of airframes within a family of systems with interoperable, modular "plug and play" payloads with standard interfaces that can be tailored to fit one or more USAF Core Functions in support of the Joint Force's priorities is dead on the mark.

The USAF's concept of employment deploys UASs to aid forces in combat and perform strike missions against pre-planned or high-value targets of opportunity, minimizing the risk of collateral damage when it is a major consideration. UAS also have the ability to take advantage of the capability inherent in the Remote Split Operations (RSO) concept to flex assets between areas of responsibility (AORs) based on Joint Force Commander (JFC) and SECDEF priorities. Most USAF assets are operated Beyond Line Of Sight (BLOS) from a geographically separated location, therefore producing sustained combat capability more efficiently with reduced forward footprint.[20]

<u>Navy / USMC</u>

While the 2010 posture statement addresses only the Naval Unmanned Combat Aerial System and the Broad Area Maritime Surveillance (BAMS) UAS, the RAND study commissioned by the Navy in 2010 highlights the goal of the Navy and Marine Corps program to provide persistent ISR support for tactical-level maneuver decisions, and unit level force protection for Navy ships and Marine Corps land forces.[21] The Naval UAS family of systems provides the Navy and Marine Corps with a diverse UAS portfolio and architecture for the battlespace awareness, maritime domain awareness, force protection, and force application required by commanders. Driven by Navy and Marine Corps concepts of operation, the UAS groups are tailored to support a specific force level, from carrier and expeditionary strike groups to Marine Expeditionary Units, regiments, and battalions.[22]

The Navy too has recognized the increasing demand from the Warfighter for unmanned aircraft that can provide ISR and is making technology investments to expand UAS operations to other mission areas. The Broad Area Maritime Surveillance (BAMS) UAS will enhance their situational awareness and shorten the sensor-to-shooter kill chain by providing persistent, multiple-sensor capabilities to Fleet and Joint Commanders. The Vertical Take-off and Landing Tactical Unmanned Air Vehicle (VTUAV) Fire Scout is currently on its first operational deployment aboard the USS McINERNEY. The Navy is also developing a medium endurance maritime-based UAS and a Small Tactical Unmanned Aerial System (STUAS) that are intended to support a variety of ships, and Marine Corps elements. [23]

Although the Navy is also working feverishly on their Unmanned Combat Aircraft System demonstration (UCAS-D), a low observable, carrier based strike / multi-role system, the study they conducted via the RAND corporation has recommended they procure some of the proven systems such as the Predator and the Reaper as a viable interim fill and a complementary system even after the fielding of the UCAS.[24]

Army

The Army, like the other services, has recognized the potential of the UAS and has invested heavily in the future of this technology. Its budget request this year includes $459 million to procure Extended Range Multi–Purpose Unmanned Aerial Vehicles; an extraordinarily capable system that achieved exceptional results in Operation IRAQI FREEDOM and is already making a difference in Operation ENDURING FREEDOM, giving commanders longer dwell ISR capabilities across the Joint Area of Operations. Additionally, a request for $505 million has been submitted to upgrade the Shadow RQ-7 UAVs. This will extend the payload capacity of the system and markedly enhance the capability which this key ISR asset provides for Brigade Combat Team Commanders.[25] One of the four compelling needs the Army recognized for 2011 is the need to increase its tactical agility, and crucial to that agility is the mission of UASs.

Army Reconnaissance Surveillance and Target Acquisition (RSTA) operations require continuous surveillance and reconnaissance to provide timely indications and warning of imminent or impending threat of attack. UAS conducting RSTA missions provide commanders with current data on enemy terrain, organization, infrastructure, and forces necessary for planning theater campaigns and major operations, including contingencies. UASs also support adaptive, real-time planning for current operations, including monitoring enemy centers of gravity, conventional attack capabilities, enemy offensive and defensive positions, deception postures, and battle damage assessment (BDA).[26]

Joint Capabilities Areas

Joint Capabilities Areas (JCA) represent a collection of related military tasks typically conducted to bring about the desired effects associated with that capability. Of the nine defined JCAs, unmanned systems contribute to eight: battle space awareness, force application, command and control, protection, sustainment, building partnerships, force support, and net centric. Current technology and future advancements enable single platforms to perform a variety of missions across multiple capability areas, representing an opportunity to achieve a greater return on investment. This technology provides opportunities for existing and future UASs to operate in the Joint environment with other Services.[27]

Rapid Growth

The rapid growth and expanding use of the UAS set the stage for issues not unfamiliar to military historians. The technological advances and capabilities which new systems bring with them have often "burst" upon the scene to fill a capabilities gap, and then floundered before finding a place in mainstream military operations and organizations. Such systems as the CSS Hunley and its counterpart the USS Alligator, the nascent submarines of the civil war, or the first foray into mechanized armored combat at the end of World War I with tanks like the British Mark I and the French Renault were seen as answers to fill a capability gap, but at the senior levels of the military, no real DOTMLPF (Doctrine, Organization, Training, Materiel, Leadership, Personnel, and Facilities) type of construct was truly used to integrate them as they emerged from concepts to fielded equipment. Both these examples were fielded in wartime on a limited basis to meet the immediate needs of commanders. When they were finally judged as having potential (not immediately in either case), significant production began on these systems. Over time, integration issues surfaced based largely on their rapid fielding during combat.

Just like the systems before it, the UAS was forged in fire to meet the demands of commanders needing to fill a capability gap. Their rapid proliferation has resulted in some issues for the Joint Force Commander as well as all the individual services. The primary issues that arose at the DoD level were related to the acquisition and management of UAS including interoperability, civil airspace integration, frequency spectrum and bandwidth utilization, ground stations, and airframe payload and sensor management.[28] In response to these issues, and in an attempt to focus this "new" technology, the Department of Defense directed the formation of a UAS Task Force (TF) in September of 2007. In April 2010, the UAS TF Charter was signed and five goals were established:

- Coordinate and evaluate DoD UAS requirements, remaining constantly conscious of technology, cost, schedule, jointness, and interoperability imperatives.
- In coordination with key UAS stakeholders, increase the operational effectiveness of DoD UASs by promoting the development and fielding of interoperable systems and networks.
- Shape DoD UAS acquisition programs to prioritize joint solutions which support costs and increase capability.
- Serve as the DoD's advocate for shaping the regulatory policies, procedures, certification standards, and technology development activities that are critical to the integration of Department UAS into the national airspace system to fulfill future operational and training requirements.

- Serve as the Department's lead activity for the development and promulgation of the Unmanned Systems Roadmap.[29]

What The Commander Needs

The establishment of the UAS TF to grapple with some very complex and service-centric issues is the first step toward addressing the challenges across the DoD. The nature of the problem most relevant for today's Joint Force Commander is the problem of interoperability. While all the other challenges are essential to address, the productivity and usefulness of all the UASs currently engaged in operations could be increased exponentially by focused improvements in interoperability. This links back to the number one request by commanders in the field: more UASs to conduct reconnaissance and surveillance.

Why is this the priority request from commanders? Because reconnaissance and surveillance from UAS provides information, which can be developed into knowledge. Knowledge is information analyzed to provide meaning and value or evaluated as to implications for the operation. It is also comprehension gained through study, experience, practice, and human interaction that provides the basis for expertise and skilled judgment, the key product of Processing, Exploitation and Dissemination (PED).[30]

The old adage that knowledge is power has been supplanted, especially in today's environment, with the precept that knowledge shared is power.[31] The Joint Commander can increase his advantages in conducting operations, by providing systematic and explicit management of the force's organizational knowledge and its Soldiers' / Sailors' / Airmen's individual knowledge.

Military staffs evolved as the need to provide knowledge to the commander and to subordinate and adjacent forces increased. Even in the time of the ancient Greeks and Romans, rudimentary staffs existed to provide knowledge to the commanders. As the complexity of warfare increased, the size and functions of the staffs expanded. However, all military staffs continued to perform two major functions: first, they carried out functions for the commanders that the commanders could not perform or that required specialists, such as engineers, artillery, and logistics. Second, military staffs developed and managed information. They gathered and organized information, analyzed it to create knowledge, and applied it in planning and decision-making. Staffs also transferred information to the commander, other staff members and higher, subordinate, and adjacent organizations.

The creation, organization, application, and transfer of knowledge were all performed manually and within individuals' minds. Some collaboration took place, but usually those involved had to be in one place. Occasionally, commanders met in a formal council of war, but this did not result in collaboration as is currently understood. Transfer of information could be accomplished by physical means, such as audible and visual signals, analogous to Full Motion Video (FMV) feeds from UASs. However, transfer of knowledge depended on messengers. Often these messengers were high-ranking officers with authority to amend instructions to fit changes in the situation that occurred while they were traveling based on their understanding of the information in their possession.

Before the nineteenth century, commanders frequently reached decisions by synthesizing the knowledge which staff officers provided them. The nineteenth century brought the rise of formal staffs that began to formalize the creation, organization, and application of the transfer of knowledge. New staff procedures allowed for more collaboration and synthesis of knowledge before it reached the commander for decision. Moreover, the formal delegation of authority to staff officers permitted them to direct functions that the commander no longer had the time or expertise to perform personally. During this period, the first nominal automation technologies were developed; among them, the telegraph, telephone, radio and phonograph. However, with few exceptions these devices could not store information, and were inadequate to relay any comprehensive knowledge. The development of electronic information technology in the second half of the twentieth century brought new capabilities for the creation, organization, application, and transfer of knowledge. These capabilities enabled collection and storage of vastly greater quantities of information, making greater quantities of knowledge available to more users.[32]

The reconnaissance and surveillance conducted by today's UAS provides an exponentially larger quantity of information than ever before. One of the accepted advantages that UASs provide is extended loiter time and persistent "stare" or surveillance. The result of this capability is that the vast amount of data that is captured now requires analysis in order to extract the 10% of data that is actually information. While some sensors have automated queuing functions, the most productive of the sensors, Full Motion Video (FMV), does not. On average it still requires 19 human analysts to process video feeds from a single Predator mission.[33] The process the analysts use to turn this data into information for the staffs, which they in turn can use to furnish to the commander as knowledge, is called PED, which stands for Processing, Exploitation and Dissemination.

Processing and Exploitation

The sensors on the UAS provide invaluable data that, through PED, is transformed into knowledge that has applications from the tactical to the theater level. The emphasis, however, still seems to be focused on improving the collection capabilities of our current systems. The ability to integrate diverse and multiple sensors provides several distinct advantages, such as better detection geometrics due to geographically separated platforms and cueing by one sensor to initiate tracking by another. These approaches would undoubtedly improve the reliability of the data gathered, and help in confirming or denying partial or suspect data.[34] However, the ability for analysts to keep pace with the increasing masses of data collected by sensors is currently beyond the capacity of existing resources. So while there is great benefit in increasing the capability of the current systems to collect data, the priority needs to be on our ability to make sense of the current data. The PED needs to be addressed as the priority.

While the 2010 report to Congress on Addressing Challenges to Unmanned Aircraft Systems does not address PED, the FY 2009-2034 Unmanned Systems Integrated Roadmap does address PED as being key to interoperability.[35] The Roadmap states that the Office of the Secretary of Defense (OSD) has established eight goals to insure the Department is headed in the right direction. Of these, goals three and four are key to the PED issue. Goal 3 directs the Department to expedite the transition of unmanned systems technologies from research and development activities into the hands of the Warfighter. This directive provides definitive guidance to equip the commanders with what they require, and to make this the priority. Goal 4 directs the achievement of greater interoperability among systems controls, communications, data products, data links, and payloads / mission equipment packages on unmanned systems, including TPED (Tasking, Processing, Exploitation, and Dissemination).

The issue of processing and exploitation has not gone unrecognized, but based on documents such as the September 2010 report to Congress addressing challenges to unmanned aircraft systems, in which PED is not mentioned, PED does not seem to be a coordinated priority.[36] In order to get the most out of the PED process and provide the commander the knowledge needed to make decisions, there are two options. One is to increase the amount of manning, but from an organization and personnel aspect, the massive expansion of personnel and facilities required to simply meet the current requirement alone is not feasible or suitable. That leads to the remaining option, which is to provide a technological solution to help analysts wade through the mass of meaningless data that is produced in order to find the gems that are of value. A similar challenge faced the National Security Agency (NSA) after September 11, 2001 when they needed to develop computer programs to data-mine vast amounts of telephone calls, Web traffic, and e-mails that they began to intercept over various networks, so the issue is not without precedent.

This pragmatic approach should drive a coordinated reprioritization of the current research and development in the area of automated target recognition algorithms and software tools focusing on more “natural” human-machine interfaces. Current programs are demonstrating excellent developments in the area of target recognition, however, high dependency still exists on the analyst / operator to decipher meaningful intelligence from automated targeting.[37]

Development of the tools that empower analysts to take advantage of all the data gathered via reconnaissance and surveillance missions from UASs which then results in the commander attaining knowledge relevant to his requirements will be a quantum leap toward integrating the UAS into the Joint fight.

Dissemination

The issue of "dissemination" as part of the PED highlights a larger issue of interoperability within the UAS community on nearly all levels. Once the data collected from the UAS missions is exploited and the leap to information is made, there is often a challenge getting the information to commanders and staffs in a timely fashion. Incompatible formats or disparate computer networks often result in staffs resorting to the age old technique of sending it via messenger, but in these cases the messenger is usually not a high-ranking officer with authority to amend instructions based on their understanding of the information in their possession.

In an attempt to reconcile this issue, the Air Force has developed a strategic vision that anticipates all services migrating to a network-centric environment with the DoD establishing a Distributed Common Ground System (DCGS) to disseminate intelligence products that are the end result of the PED process. This will include "live feeds" from the sensors themselves to units in the field. UAVs will feed information into the DCGS "to improve information sharing, enhance the quality of information and situational awareness, enable collaboration and mission agility, and enhance sustainability and speed of command." This vision places significant hopes on the evolving network-centric capabilities of the Joint force to ensure each unit can receive information from all available sources, such as directly from the unmanned system or from DCGS. But just as the technological solutions are needed to insure all gathered data is examined in the PED, the investment in an all-encompassing solution to execute the “dissemination” portion of the PED is vital to ensuring the commanders obtain the knowledge they require in time for it to be of value. [38]

An additional example of the disjointed rise of the UAS and a related interoperability issue within the Joint community, with respect to Groups 1-3 UASs, is the general inability of the UAS Ground Control Station (GCS) to process, prepare, and disseminate FMV and metadata information from reconnaissance and surveillance missions. This once again calls into question whether all the current data about the operational environment is even making it into the PED process. The UAS units have the capacity to furnish recorded FMV missions to service intelligence agencies for analysis, but once again this is usually done via messenger because of the inability of the networks to handle data on that scale.[39]

The focus on metadata is a critical component for the entire PED process which applies to all UAS Groups, and is still an issue in the joint UAS community. Metadata is the data, in this case embedded in the FMV, which documents who, what, when, where, why, and how the FMV was collected. It is the information that allows the FMV to be indexed and therefore be searchable, allowing analysts to cross-reference new data with archived information such as geographic locations, coordinates, time periods, and specific FMV missions. Without the embedded metadata, a place to archive the FMV (a phenomenally large amount of data), and a system to access it, the exploitation phase of PED becomes very shallow, and volumes of potentially valuable information go unexploited.

The Larger Issue of Interoperability

Even though Department of Defense Directive 5000.1 established the requirement to acquire systems and families of systems that are interoperable, some UAS programs were not designed to meet joint service requirements or interoperability communications standards. As a result, they cannot easily exchange data, even within the same military service. Additionally, certain electromagnetic spectrum frequencies that are required for wireless communications are congested because a large number of UAS and other weapons or communications systems use them simultaneously.[40]

The establishment of the Unmanned Aircraft System Task Force (UAS TF) was a concerted effort by the DoD (as directed by Congress) to address what it viewed as a system with remarkable potential, hampered by some remarkable incongruities across the Services. These incongruities manifest themselves in inoperability issues across numerous aspects of the disparate UAS programs. The interoperability between these systems will continue to hamper the staff as they try to frame the environment and give the Joint Force Commander a true understanding, or Common Operating Picture (COP).

Conclusion

Although the mission sets for Unmanned Aircraft Systems are numerous and varied, the Combatant Commanders continue to request them to provide reconnaissance and surveillance more than any other mission. Based on their abilities to provide a persistent presence and to afford the commander access to an overwhelming amount of information, the high demand for this capability will not soon diminish. In fact, with the uncertainty posed by the hybrid threat, the demand for information / knowledge is more likely to increase.

There is no doubt that the disjointed rise to preeminence of the UAS resulted in systems that are not interoperable, and a process that does not provide the commander with a true picture of what all the systems can acquire. There is, however, not currently a better collection of resources that can accomplish what this fragmented system does. The vision needed to orchestrate these capabilities into a much better system can be seen in the creation of the UAS Center of Excellence and the UAS Task Force. They are a step in the right direction toward solving many of the interoperability issues.

While the DoD is delving into most every aspect of the UAS program in an attempt to bring order to a relatively chaotic set of interoperability quandaries, to date the evidence of a concerted focus on the Processing, Exploitation and Dissemination (PED) process appears scant. Regardless of what other issues abound, the pivotal focus must be to provide the commanders with what they consistently ask for from the UAS community: knowledge about the enemy, terrain, and all other aspects of the battlefield that the UAS can provide. That knowledge can only be provided by a flow of information through integrated systems that are woven through the PED process. If this does not happen, then the Joint UAS community has failed the commanders.

Endnotes

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